Collisional processing of comet and asteroid surfaces: velocity effects on absorption spectra

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A new paradigm has emerged where 3.9 Gyr ago, a violent reshuffling reshaped the placement of small bodies in the solar system (the Nice model). Surface properties of these objects may have been affected by collisions caused by this event, and by collisions with other small bodies since their emplacement. These impacts affect the spectrographic observations of these bodies today. Shock effects (e.g., planar dislocations) manifest in minerals allowing astronomers to better understand geophysical impact processing that has occurred on small bodies.

At the Experimental Impact Laboratory at NASA Johnson Space Center, we have impacted forsterite and enstatite across a range of velocities. We find that the amount of spectral variation, absorption wavelength, and full width half maximum of the absorbance peaks vary non-linearly with the velocity of the impact. We also find that the spectral variation increases with decreasing crystal size (single solid rock versus granular). Future analyses include quantification of the spectral changes with different impactor densities, temperature, and additional impact velocities.

Results on diopside, fayalite, and magnesite can be found in Lederer et al., this meeting.